PENTIUM-4 RAMBUS PC PERFORMANCE WITH NEC-4.1

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Four 1.4-GHz Pentium-4 "clone" PCs were recently purchased and tested. These PCs are based on the Intel D850GBAL motherboard with 512-MB of ECC RamBus RDRAM memory. One of the four PCs was loaded with Windows-NT and performance tested for floating point, network and disk I/O speed. Double-precision floating point performance was evaluated using NEC-4.1's matrix factor timing data, as shown in Table-1 below. Table-2 compares the P-4 RamBus based PC performance with that of the earlier P-3 SDRAM based PCs. Table-3 shows basic disk performance for the P-4 test PC using the HDTACH disk performance test program.

P-4 PCs with RamBus RDRAM memory provide significant 5X to 6X performance improvements over older P-3 based systems with PCC-133/100 SDRAM memory. However, GNEC's FPU code optimizations and multiple CPU support provided similar performance improvement in matrix factorization for the 550-MHz Dell dual-P3 system. It will be interesting to see how well this carries over to multiple CPU P-4 RamBus based systems.

The P-4 test PC's network speed with an Intel Pro/100 S Desktop IPsec 3DES PCI bus Ethernet adapter was measured at 7.88-MBytes/sec for the COPY command and 7.46-MBytes/sec for the FTP GET command. The test server was running Netware-5.1. Note that the Intel D850GBAL motherboard has an onboard Ethernet adapter that provided transfer rates in the 6.2 to 6.8-MBytes/sec region.

This is very impressive performance for a baseline PC in the $1200 price range (w/o monitor, keyboard, mouse). Further, it provided 94% of the 1.7-GHz Dell Dimension-8100's NEC factorization performance at roughly 60 to 75% of the Dell's cost, after adjusting for differences in memory and other accessory/option items. The sluggish PC (and especially the memory) markets have made fast P-4 RamBus based PC systems very affordable for desktop office, scientific and engineering applications. As usual, your EPA mileage may vary...

Finally, this workstation PC boots Windows-NT in 15-seconds flat from the Windows-NT boot menu to the Ctrl-Alt-Del login splash screen. This is the fastest Windows-NT boot I've ever experienced with an IDE/UDMA boot disk drive based PC.

Table 1. 1.4-GHz P-4 RamBus PC Performance for NEC-4.1 under Windows-NT V4 SP6A.

No. seg.	Fill (sec)	Factor (sec)	Total	Pagefile size	Estimated MFLOPS*
600	1.652	1.092	2.924 sec		n/a
1200	6.459	8.302	15.352 sec		555.0
2400	25.597	66.004	1.557 min		558.5
3600	57.653	222.30	4.731 min		559.7
4800	183.273	1126.60	23.316 min	1.7-GB	261.8**
7500	453.172	4628.63	1.469 hr	2.9-GB	243.1**
10000	780.162	13336.62	4.024 hr	6.6-GB	200.0**

* Estimated MFLOPS/sec based on $[8/3 * (\# \text{ Segments})^3]$ / [Factor Time] for 1,000 or more segments.

** Swaps to disk – not enough RAM. For this compiled version of NEC-4.1, the maximum RAM used was about 283-MB including the OS.

Table 2. Some comparisons for 1200-segments with other recent PCs.

Machine	Fill (sec)	Factor (sec)	Total (sec)	Estimated MFLOPS
550-MHz P-3 dual-cpu Dell 610 with 2-GB RAM	10.21	6.65	n/a	692.9
1.7-GHz P-4 Dell Dimension-8100 with 1-GB RDRAM	5.49	7.800	13.900	590.8
1.4-GHz P-4 Intel D850GBAL motherboard with 512-MB RDRAM	6.459	8.302	15.352	555.0
850-MHz P-3 Gigabyte GA-BX2000 motherboard with 512-MB PC-100	7.881	47.408	56.120	97.2
933-MHz P-3 Gigabyte GA-6VXD7 motherboard with 1-GB PC-133	7.250	49.453	57.453	93.2

Notes:

a) 550-MHz P-3 data provided by Keith Lysiak of SwRI. Data from GNEC code execution using the Intel MKL/Lapack libraries with dual-CPU support and Pentium FPU optimization. GNEC is an enhanced NEC-4.1 from Nittany-Scientific.

b) 1.7-GHz P-4 NEC-4.1 data provided by Jerry Burke of LLNL, the author of NEC.

c) Except for the 550-MHz P-3, all data came from NEC-4.1 code compiled by Compaq (previously DEC) Visual Fortran compiler.

Table 3. The P-4 test PC's disk I/O performance measured by HDTACH between the outer and inner cylinders. The disk drive is a 30-GB IBM Deskstar, 7200-rpm, 2-MB cache/buffer, 8.5-msec seek time drive.

Maximum sequential disk I/O rate:	41.62-MB/sec
Minimum sequential disk I/O rate:	8.80-MB/sec
Average sequential disk I/O rate:	32.01-MB/sec
Random access time:	13.4-msec